over the two-wire plan, is, that if needed for purposes of driving motors, or for large street-lamps of higher resistance, a potential twice as high as the ordinary one is very simply available by connecting across from I to III, or three times as high from I to IV in the four-wire plan, etc.; and, no matter what the amount of such employment, it will not disturb the balance of the intermediate lower potential circuits.

H. M. PAUL.

ZOÖLOGICAL RESEARCHES OF THE SCOTTISH FISHERY BOARD.

THE Scottish fishery board has for its principal function the administration of public matters relating to the fisheries of Scotland; but since its reconstitution in 1881 it has been endeavoring to perform some of the functions so successfully exercised by the U. S. commission of fish and fisheries. It has recently published its report for the year 1883, the second annual report since its reconstitution. In the general report, a short introduction is followed by a chapter on the herring. The first part of this consists of a summary of inquiries into the natural history of the herring, carried out before the year 1882; to this succeeds a summary of the history and results of similar work done in foreign countries; and, finally, there is an account of the researches undertaken by the board since its reconstitution. The rest of the report is taken up with statistics of the various fisheries, and a few paragraphs on the salmon-fishing.

The remaining and of course much the larger portion of the volume is devoted to the various appendices, in which fuller details are given on matters discussed in the general report. Of these, Appendix F describes the investigations carried out at the instance of the board, while Appendix G is Mr. Young's report on the salmon-fisheries.

The biology of the herring, of course, occupies a prominent place in the volume; and in its discussion there is a tendency to optimistic assumptions, which are not in accord with the true spirit of research. For example: the board, or its scientific committee, proposes in the present autumn to deposit, on some of the inshore banks in the Moray Firth, some millions of fertilized herring-eggs; and then, if next year the said bank is visited by a shoal of comparatively small herring, it will conclude, 1°, that they are the produce of the eggs deposited this year; 2°, that herring, like salmon, when about to spawn, instinctively seek their birthplace; 3°, that the migration of herring is limited, and that, in course of time, special varieties of herring may have been formed at different parts of the coast; and 4°, what is of even more importance, that when any particular spawning-ground is deserted, the fishing may be restored without waiting till accident brings another shoal. Investigation would be a very simple matter, if every experiment were as fruitful in inferences as this. The board will have to prove, in the first place, that the herrings, if it finds them next year, are the produce of the eggs it has laid down. He is a wise herring-breeder that knows his own herrings in the open sea.

Professor Ewart's essay on the natural history of the herring forms No. iv. of this appendix. It is, for the most part, an abstract of a paper read by him before the Royal society of London, on the spawning of the herring, and the examination of a spawning-bed at Ballantrae, on the west coast of Scotland. Professor Ewart observed for the first time the spawning and fertilization of herring-eggs in an aquarium. The process, as he describes it, is probably the same, or nearly, as that which takes place in the sea. But it would have been more satisfactory, if, when he had the opportunity, he had observed the behavior of a number of male and female herrings in the same tank. In his experiment there was but a single female herring. The discussion of other problems connected with the life-history of the herring is not very luminous. The author concludes that herring have come to spawn in spring and autumn because the food of the young fry is more abundant at those seasons than at others; but he has no evidence to show that minute pelagic animals are less abundant at a given place in summer than in spring and autumn. A quantitative investigation of the pelagic life at a given spot throughout the year has not yet been carried out, and such a research would be very valuable.

The report on the sprat-fishing, by Mr. Duncan Matthews, contains a record of much good and interesting work, and raises a question of general interest in marine biology. A certain proportion of young herring are killed with the sprats in the firths of Scotland, and herring-fishers believe that this injures their industry. This contention does not seem very important, after such a season as the last, when herrings were so plentiful off the east coast of Scotland that it was almost impossible to find a market for them. But it is of interest to note the difficulty of deciding whether the abundance of a species depends more on the variations in its food-supply than on the attacks of its enemies, or *vice versa*. It is possible, in the case of the herring, that the destruction caused by all its enemies, including man, is insignificant in comparison to its breeding-powers, and that the number which reaches maturity depends entirely on the amount of food available.

PSEUDO-SCIENCE.

The true theory of the sun. By THOMAS BASSNETT. New York, *Putnam's*, 1884. 41+263 p., illustr., 1 pl. 8°.

WE nowhere find in this volume a systematic attempt to arrive at legitimate deductions from all the collected work of observational astronomy and meteorology; but page after page is devoted to the author's baseless speculations, and to the details of such of his own isolated observations as serve to confirm these speculations, while the labors of others, not condu-